# MENUFIA-SOHAG PROJECT

## Report on Wheat Harvesting in the Sohag and Menoufia Govenorates.

G. Delfosse, R.Pirot.

August 1983

National Institute of Agricultural Engineering

Wrest Park Silsoe Bedford UK

CEEMAT Parc de Tourvoie 92160 Antony France

NIAE

CEEMAT

G.E.R.D.A.T.

CENTRE D'ETUDES ET D'EXPERIMENTATION
DU MACHINISME AGRICOLE TROPICAL
(C.E.E.M.A.T.)

PARC DE TOURVOIE

92160 ANTONY - (France)

TEL. 668.61.02

TELEX : 201 296 F

# REPORT OF MENUFIA & SOHAG

# PROJECT

# WHEAT HARVESTING PROCESS

G. DELFOSSE

R. PIROT

CEEMAT est un Centre de Recherches - Développement du Groupement d'Etudes et de Recherches pour le Développement de l'Agronomie Tropical (GERDAT)
Paris B 703001776 - SIRET 70300177600011 Siège Social : 42 rue Scheffer - 75016 Paris

*Le CEEMAT fonctionne en collaboration avec le Centre d'Etudes du Machinisme Agricole, du Génie Rural, des Eaux et des Forêts (CEMAGREF)*

# C O N T E N T S

# FOREWORD AND CONCLUSIONS

# PROPOSAL FOR THE DEVELOPMENT OF A WHEAT HARVESTER SUITABLE TO EGYPTIAN CONDITIONS

## 1 - What is the available equipment for harvesting wheat in Egypt ?

During the last wheat harvest in May 1983 several machines were tested as agreed under the M.S.P. contract. These tests can be summarized as follows (for more details see attached reports).

Japanese - type combine harvesters (Yanmar TC 3500) : this type of machine is not suitable for wheat or, more generally, for crops which are not row-planted.

Conventional wheat combine harvesters (Deutz Fahr) : in spite of good results, this type of machine does not provide a height of cut acceptable to farmers, and requires subsequently the use of a tractor with a baler so as to collect the straw left behind the combine and clear the field for the next crop.

Moreover, due to the size of combines and to the area of wheat plots which are commonly found in Egypt, loss of operating efficiency is greater with combines than with any other machine. The use of combine harvesters should be considered in conjunction with modification of plot layout and land levelling to provide larger areas for their operation.

Tractor mounted or self propelled mowers : (Kubota mower, Ferrari mower)

These machines work more or less satisfactorily in the tall Egyptian wheat, depending on the type of cutter-bar and shape of the swath boards. The advantage of self propelled mowers is their ability to harvest the sides of fields. However for all mowers a great amount of manpower is needed for the gathering and binding of sheaves an operation which causes grain losses in mature wheat.

Tractor-mounted mower-binder (Agostini) : there is no doubt that this machine was identified as the most satisfactory both by the technicians as well as the farmers. Reasons for this are :

- good manoeuvrability in small plots, as the machine is mounted on the tractor
- this is the only machine which delivers the crop (bound sheaves) ready for transportation, which saves manpower for later treatment
- the height of cut is acceptable
- low power requirement in the field.

There are still some drawbacks to this machine

- grain losses occur during gathering of sheaves and their dropping in the field

  the binder is a delicate machine subject to breakages, and some components require sophisticated manufacture
- when mounted on the Universal 65 hp tractor (1st f. gear : 3 - 6 km/h), the machine blocks in heavy crops and requires a 2 km/h forward speed
- the cost of twine is considerable and twine cannot be re-used by the machine during subsequent harvests
- the sheaves produced are not very suitable for subsequent feeding into a thresher.

## 2 - Description of the proposed prototype

### 2.1. Principle of operation

The proposed machine may be called a "mower-baler". It is made of two main components; the cutter-bar, mounted on the offside, and the baler chamber, mounted within the wheel track of the tractor. Between these two components are two belt conveyors (one horizontal, one elevating) which convey the cut crop to the bale chamber.

The unit would be fully mounted on the tractor linkage. The operating principle of the baler would be in common with the big hay round-balers used in Europe, but with an attempt to simplify the design

by reducing the dimensions, and adapted to baling whole crop wheat instead of hay.

The cutter bar would be similar to existing ones.

## 2.2. Dimensions and performance expected

| | |
|---|---|
| cutter-bar width | 1,20 m |
| reel diameter | 1,50 m (same width) |
| conveyor width | 0,90 m |
| 1st conveyor length | 1,40 m |
| 2nd conveyor length | 1,15 m |
| inclination of 2nd conveyor | 25° |
| bale width (height) | 0,90 m |
| bale diameter | 1 m |
| bale density | 120 kg/m³ |
| overall weight | 600/800 kg |
| working speed | 3,6 km/h |
| rate of work, not including turning time | 2,5 hours/ha |

## 2.3. Main advantages expected with the machine

- Good height of cut, quick clearance of straw and grain from the field in one operation, good manoeuvrability, low power requirement (as with the Agostini)

- Simple design : all axles are parallel, no gearbox, no castings, no casings

- Large bale with an average weight of 70 - 80 kg assisting handling and transportation

Better crop feeding of existing Egyptian threshers

- Minimization of grain losses and harvesting costs.

## 2.4. Costings

### 2.4.1. Design - Prototype fabrication

One design team including 1 engineer (consultant), 1 project engineer, 1 designer, 2 craftsmen

Work schedule; January 1st 1984 to June 31st 1984, i.e. 6 months

Collaboration of an Egyptian engineer

### 2.4.2. Materials

Standard components

Special components

### 2.4.3. Trials in France, Modifications and re-design (July 1984)

One month of the design team's time

### 2.4.4. Transportation of the prototype

Paris to Alexandria (August 1984)

### 2.4.5. Trials in Egypt

Rice harvest (Nov. 84) or wheat harvest (May 1985)

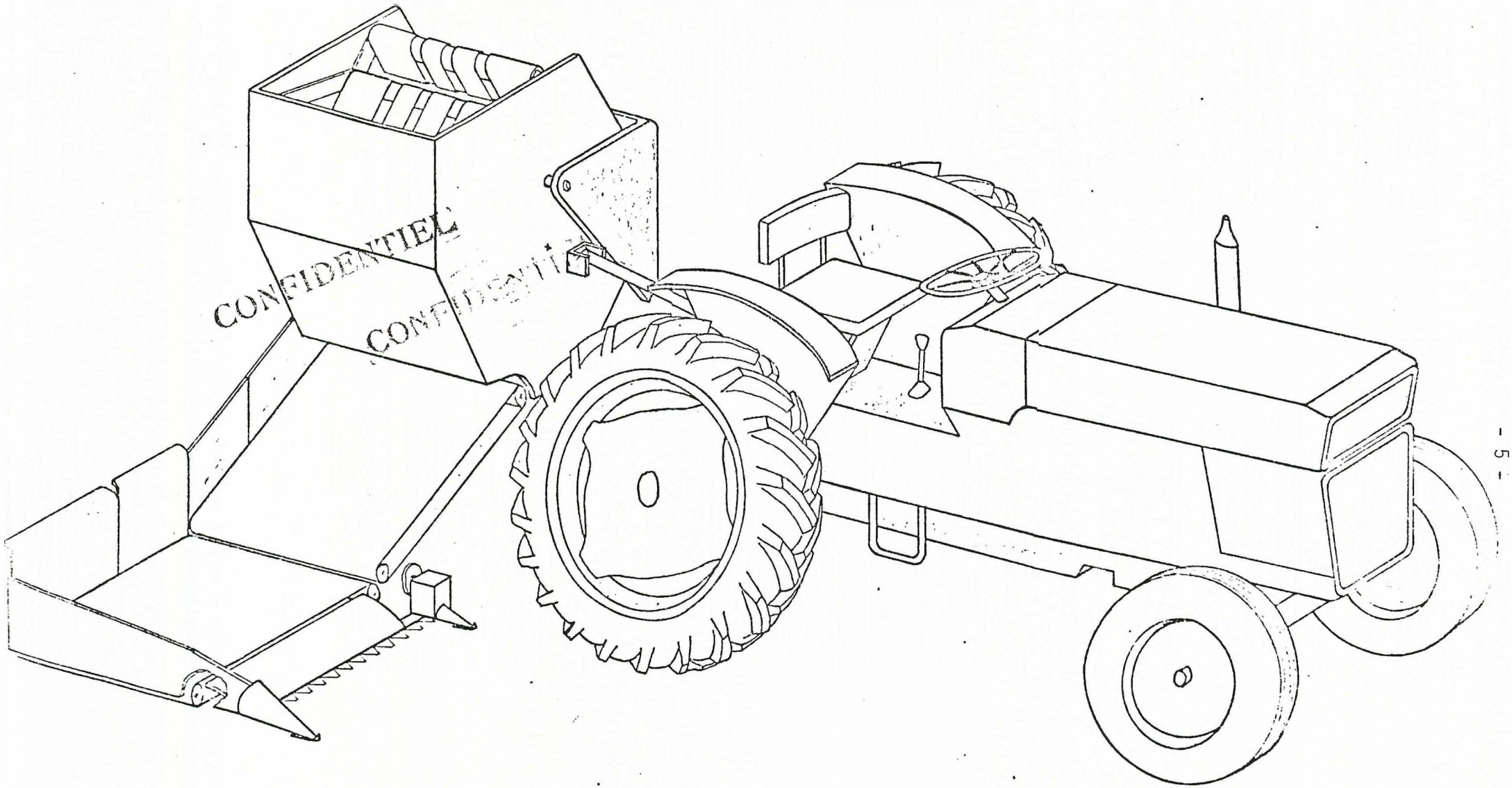
4 weeks in Egypt

2 return passages (Paris-Cairo)

Consultant engineer (M. DELFOSSE), borne by MSP

Local travelling and operating costs, borne by MSP

TOTAL 1.107.000 FF


CONFIDENTIEL

## SCHEDULE OF THE MISSION OF Mr. DELFOSSE AND Mr. PIROT

| | | |
|---|---|---|
| - 9th May | : | Paris-Cairo |
| - 10th May | : | Meeting with MSP |
| - 11th May | : | Visit to Menufia Farm |
| - 12th-17th May | : | Mr. DELFOSSE - Travel to Sohag<br>Assembling the machines<br>Finalising the test<br>Procedure |
| | | Mr. PIROT - Stay in Menufia<br>Finalising the test<br>Procedure |
| - 18th-23rd May | : | Test of the machines in Menufia |
| - 24th-27th May | : | Mr. DELFOSSE - Travels to Sohag<br>Testing the machines |
| | | Mr. PIROT - Stays in Menufia<br>Testing the machines |
| - 28th May | : | Visit to Behera Company in Alexandria |
| - 29th May | : | Meetings with MSP |
| - 30th May | : | Cairo-Paris |

# REPORT ON THE MENOUFIA-SOHAG PROJECT
# WHEAT HARVESTING TRIALS

-0-

The day to day report is available from the Team Leader and the time spent preparing each machine and its test procedure will be covered separately.

+ MACHINE TESTED

SYSTEM CLASSIFICATION

Among these seven operations there are three systems :

| | | |
|---|---|---|
| I - | Combines | Cutting, threshing, separation and cleaning |
| II - | Binder | Cutting, collecting, tying |
| III - | Mowers | Cutting and swathing |

+ HARVESTING SYSTEMS TO BE EVALUATED

+ THIS REPORT INCLUDES :

- a brief description and comment on each machine
- an operational report.

## I - COMBINES

### A - Deutz FARH Combine

In spite of the presence of a German Technician and the representative of FARH DEUTZ in Egypt, we had to set the machine for proper threshing and reduction of losses as unthreshed heads (concave adjustment and alignment with the cylinder).

The machine is well built (very conventional design) and the various settings and adjustments are available to cope with any field conditions, except for the cylinder speed which is inadequate for certain crops such as bearded wheat or barley.

The chain drive provides either 780 RPM or 1.040 RPM for cereals, which is obviously too wide, and either a variable speed drive or additional sprockets are needed.

In operation, the machine worked well but it lacks manoeuvrability in small fields. Steering and independant brakes are hard to operate and provide a too large turning circle.

The main criticism is the inability to control an accurate height of cut. This is due to the ratio wheel base lenght : front wheel to cutter bar lenght and is of course the same on all combines.

Poor levelling of the soil and the irrigation ditches make cutting very difficult, so the effective height of cut is varies between 18 - 25 cm.

The rate of work (0.8 Fed/h) is not bad, but the forward speed control is slow in acting and consequently many operators are not able to readjust quickly enough when travelling speed requires variation under field conditions.

The reel also has a tendency to cause wrapping around its tubes and tines causing ear losses.

Machine tested : Combine harvester
Made : Deutz FAHR
Type : M 980 3 meters cutting width
Date : May 1983 the 21 st TEST 1
May 1983 the 22 nd TEST 2
Hour : 1200 to 1700
Place : Centris in Ahmed Farid holding
Variety : SAKKA 61

| T E S T | | 1 (*) | 2 |
|---|---|---|---|
| Moisture content of the grain | | 13,4 % | 12,5 % |
| Clearance between drum and concave | front | 12 mm | 12 mm |
| | rear | 5 mm | 5 mm |
| Drum speed | | 1040 rpm | 1040 rpm |
| Forward speed in work | | 1,59 km/h | 2,47 km/h |
| Harvested acreage | m² | 10 605 m² | |
| | feddan | 2,52 fed | |
| Field yield | kg/ha | 4 964 | 6 000 |
| | kg/feddan | 2 084 | 2 520 |
| Field dimensions (m) | length | 145 m | |
| | width | 73 m | |
| Time of access (FARAONIA CENTRIS) | | 2 hours | |
| Total time in the field | | 3 h 12 | |
| Turning time (total) | | 28 mn | |
| Time for 1 operation to fill hopper | | 1 h 15 | |
| Time to empty the hopper (machine stopped) | | 5 mn 40 s | |
| Fuel consumption | | 7,6 l/h | |
| Height of cut (100 samples) | | 24,5 cm | 18,5 cm |

| T E S T | | 1 (*) | 2 |
|---|---|---|---|
| Capacity of machine | | medium | optimum |
| Capacity of machine average | $m^2/h$ | 3314 $m^2/h$ | |
| | feddan/h | 0,79 fed/h | |
| Time to combine | 1 feddan | 1 h 16 mn | |
| | 1 ha | 3 h | |
| Losses as % of the yield | Cutter bar | 0,12 % | 0,12 % |
| | rear of the combine | 0,50 % | 0,53 % |
| Impurities as % of the grain (hopper) | clean grain | 95 % | 96,6 % |
| | broken grain | 2 % | 2 % |
| | straw and husks | 1,7 % | 1,3 % |
| | other grain (weeds) | 1,3 % | |

$\bar{M}$ = 1,27 h/fed

(*) The rate of work test was made in low gear because of ridges in the field made driving unconfortable.

B - The YANMAR Diesel Combine TC 3500

This machine is a conventional Japanese rice harvester.

Two reaping knives cut the crop which is carried upwards by two vertical conveyors using chains and fingers to convey the material along a cylinder.

The straw is fed along this cylinder and the heads (ears) are threshed between the peg drum and the concave. Then the straw is discharged at the rear of the machine either through a chopper consisting of a series of circular knives, or by vertical discharge forming a swath on the ground.

The machine was set up by a Yanmar Technician and we drove it to the field.

Within a few metres (3 to 5) the machine was blocked which caused the warning buzzer and lamp to come on but without an operator's manual the problem could not be traced. The next day we found a blockage in the return auger and its blower.

The belt drive was correctly set and we tried again without success.

The amount of loose crop heads was too great and the threshing inadequate for that type of crop. We proposed to make some readjustments but we doubt that these could solve this lack of threshing capability.

Feeding of the crop is difficult since the variation of lenght of straw is too great for the adjustment provided to cope with it hence the ears are not properly presented into the cylinder/concave area causing bad threshing.

The fan and sieve adjustment could reduce the amount or returns but the losses would then be unacceptable.

It is concluded that this machine has not been designed for wheat harvesting and especially the type of crop popular in Egypt.

The width of gather between each divider is one of the main causes of problems and explains the large variation of ear location in the threshing area.

These difficulties were acceptable in a large (6 feddans) field but would have been unacceptable in the small fields where we had to work with other equipment.

The access to the field is also a general problem which is not specific to this machine. We had to cut away 10 meters of fence to drive the machine to the site without running over existing crops and none of the other wheat fields could have been reached without damaging other crops.

## II - BINDER

### AGOSTINI BINDER

This binder has been designed for rice or shorter crops than the Egyptian wheat.

However it works satisfactorily up to a certain yield above which we could not use the 65 HP universal tractor because of its too fast first gear (3.5 km/h).

Two alternative packers feed a central outlet where the knotter ties a sheave adjustable in size by means of a spring loaded holding plate.

This adjustment is a little crude and sheaves are not regular either in size or in weight.

The main criticism lies in the packing-feeding device which causes too high head losses when crops are really ripe, by handling and shaking the stalks roughly. (Mainly because of ears breaking).

The knotter has practically no adjustment except for the twine retainer and its satisfactory operation depends on rough cast parts such as the bill hook and its cam. This causes the knotter mechanism to be very sensitive to twine size and variations of twine can cause mistying with very little chance to overcome this problem.

The two machines (Sohag and Menufia) were equipped with two different rear conveyors :

- one made of plastic canvas
- the other of chains and slats.

AGOSTINI BINDER

Trials on wheat - MENUFIA FARM.

| TRIALS | 1 | 2 | 3 | 4 | OBSERVATIONS |
|---|---|---|---|---|---|
| Yield grain - kg/Fed | 4360 | 4360 | 2700 | 2068 | |
| Harvested acreage - m² | 1870 | 209 | 2607 | | |
| Total time | 70 mn | 6mn35 | 1h25mn | | |
| Pausing time | 6mn30 | 40 s | 14mn45 | | |
| Theorical width - m | 1,30 | 1,30 | 1,30 | | |
| Actual working width - m | 1,20 | 1,20 | 1,06 | | |
| Forward speed - km/h | 1,4 * | 1,59 | 1,5 * | 2 | |
| Capacity - Fed/h | 0,38 | 0,45 | 0,44 | 0,57 * | |
| Fuel consumption - l/h MF 265 | - | - | 2,84 | | |
| Grain losses Head<br>Rear | 0,4%<br>2,4% | - | - | 0,5 %<br>2,2 % | - |
| Height of cut - cm | | | | | |

* Estimation

M̄ = 2,4 hours/Fed.

This last model is more efficient but too harsh and causes some losses.

The first one is not positive enough and sheaves sometimes locked in the rear corner resulting in a stoppage if someone does not follow the machine to avoid this.

The packers are rather low and cause excessive acceleration of the crop which is certainly the main cause of losses. The chain, or canvas also causes grain and head losses and the ejection of the sheaves is also critical. The drop causes losses but also lays the sheaves along the next tractor wheel track which sometimes creates damage to the crop.

To avoid this problem and that of dragging sheaves along the ground which also caused losses an extension was fitted but with little success.

The twine cost is considered too high by the farmer and this is not easy to solve.

The average output (0.38 to 0.57 feddans/h) is rather low for a 55 HP tractor. This means a relatively low output by this binder which is accentuated in the canvas conveyor type machine.

In fact, as this machine is mainly designed to harvest the top part of the crop, this results in a collecting and binding system unsuitable to Egyptian conditions.

However the machine is accepted by users and many farmers were asking for it.

## III - THE MOWERS

| | | |
|---|---|---|
| 2 types | Self - propelled | (Ferrari) |
| | Tractor mounted - | (Kubota) |

The FERRARI mower again has not been designed for tall crops and the swath board is not able to reduce the swath width to cope with the wheel tracks and ground clearance.

This is the cause of many problems by blocking or passing over the crop.

The machine is heavy to drive and use of the independent clutch is obligatory (the clutch control was out of order on one machine and had to be fixed). But the main asset of this machine is its ability to open fields as opposed to side mounted machines.

## FERRARI SELF PROPELLED MOWER

Trials on wheat - MENUFIA FARM.

| TRIALS | 1 | 2 | 3 | 4 | OBSERVATIONS |
|---|---|---|---|---|---|
| Yield grain - kg/Fed | 2252 | 2248 | 8773 | 5348 | |
| Harvested acreage - m² | 2000 | 219 | 220 | 219 | |
| Total time | 33mn30 | 5mn10 | 3mn30 | 5mn30 | |
| Pausing time | NM | 35 s | 10 s | 20 s | |
| Theorical width - m | 1,40 | - | - | - | |
| Actual working width- m | 1,25 | - | - | - | |
| Forward speed - km/h | 3,0 * | 2,03 | 3,10 | 2,29 | |
| Capacity - Fed/h | 0,85 | 0,57 | 0,90 | 0,61 | |
| Fuel consumption - l/h | 0,54 | - | - | - | |
| Grain losses Head<br>Rear | | | | | |
| Height of cut - cm | 9,1 | | | | |

* Estimation

M̄ 1,4 H/Fed.

## BUSATIS MOWER

Trials on wheat - MENUFIA FARM.

| TRIALS | 1 | 2 | 3 | 4 | OBSERVATIONS |
|---|---|---|---|---|---|
| Yield grain - Kg/Fed | 3617 | | | | |
| Harvested acreage - m² | | | | | |
| Total time | | | | | |
| Pausing time | | | | | |
| Theorical width - m | 1,5 | | | | |
| Actual working width-m | 1,25 | | | | |
| Forward speed - km/h | 4,8 | | | | |
| Capacity - Fed/h | | | | | |
| Fuel consumption - l/h | | | | | |
| Grain losses Head / Rear | 2,6 % | | | | |
| Height of cut - cm | 4,8cm | | | | |

## MITSUBITSHI MOWER

Trials on wheat - MENUFIA FARM.

| TRIALS | 1 | 2 | 3 | 4 | OBSERVATIONS |
|---|---|---|---|---|---|
| Yield grain - kg/Fed | 3845 | | | | |
| Harvested acreage - m² | 2214 | | | | |
| Total time | 25mn10 | | | | |
| Pausing time | - | | | | |
| Theorical width - m | 1,50 | | | | |
| Actual working width- m | 1,26 | | | | |
| Forward speed - km/h | 4,34 | | | | |
| Capacity - Fed/h | 1,26 | | | | |
| Fuel consumption - l/h | 1,95 | | | | |
| Grain losses Head<br>Rear | 3 % | | | | |
| Height of cut - cm | 5 cm | | | | |

M̃ = 0,8 H/Fed.

* The 3-point linkage MITSUBITSHI MOWER works well and the stub-guards are efficient in that sort of crop. We had few problems with the swath board which again is a little small for this tall straw but the job is possible and the cutting speed acceptable.

However, while the use of mowers provides the ability to cut and make a swath it does not make sheaves as a reaper would do, and when picking up the crop considerable time is spent to gather the material, and losses due to handling mature crops are inevitable.

Evaluation of these losses is difficult since they depend on the care with which crop is being handled. When compared to hand cutting we have to underline the fact that a well trained worker does not lay down each handful of crop but has it supported by the standing crop, until he has cut enough to form a sheave. Then he lays the full amount behind himself ready to tie the sheave.

This conventional technique reduces the head losses as compared to mower cutting.

Mitsubishi and Busatis mowers are designed to cut the crop lower than conventional mowers.

## IV - THE THRESHERS

The only ones we could observe were the two CRS models but the design is very similar to any of the drum threshers used in Egypt.

The ALVAN BLANCH and the CICORIA were prepared for use but not tested during our stay in MENOUFIA, but we managed to set up a small CRS thresher in SOHAG and in spite of a poor main drive (Defective belt and misalignment of the engine and main pulley) to test this machine.

### A - CRS threshers

#### a) First test (model A)

The main drive is critical

The diameter of the drive pulley is small and the 10.5 HP engine could never be fully loaded because of this drive weakness. However we adjusted the thresher yield at about 100 kg of grain an hour, which is a low capacity, but without losses and good chopping of the straw.

The main points are :

1 - The drum does not draw the crop in.

The crop has to be pushed in to feed the machine.

2 - Lack of capacity of the drive.

The machine blocked several times in the process of finding its maximum capacity.

3 - Low capacity of the cleaning system

There is no lift on the sieve movement hence the large amount of broken straw and chaff overloading the sieves and the fan cannot be used at full output without increasing losses. The sample was clean with the help of the last separation in the grain outlet, but in the grain auger the percentage of impurities (mainly straw and green material) is still high.

4 - The straw capacity is low

Since the chopped material has to go through the concave perforations, the straw remains in the cylinder/concave zone, for a long time before reaching the stage of being able to pass through the screen holes.

b) During M. AHMED A. BAGHAT'S stay we had the opportunity to duplicate the test on a newer model of this thresher (model B).

The main change is an open cylinder, with discs replacing the solid drum.

The grain yield reached 400 kg of grain/hour with a well trained team of people feeding the machine.

The main drive was better in spite of the same pulley's diameter and the motor was loaded several times during the test.

Losses in the straw were negligible and the sample was clean after several adjustments to the fan output, but here again the sieve overloaded and the grain remained on the very last part of the sieve mixed with a thick mat of straw and chaff.

## CRS THRESHER

Trials on wheat.

### Type A standard (solid drum)

Fan 1/2

| TRIALS | 1 | 2 | 3 | | |
|---|---|---|---|---|---|
| Nb of sheaves | 10 | 10 | 5 | | |
| Weight of sheaves (kg) | 27,2 | 27,7 | 13,0 | | |
| Time | 2mn37 | 2mn37 | 1mn25 | | |
| Grain (kg) | 9,3 | 9,3 | 3,9 | | |
| Straw (kg) | 12 | 11 | 5,5 | | |
| Drum speed (RPM) | 508 | | | | |
| Capacity (kg/h) | 213 | 257 | 165 | | |

### CRS Type B (open cylinder)

| TRIALS | 1 | 2 | 3 | | |
|---|---|---|---|---|---|
| Fan | 1/3 | 1/6 | 2/3 (open) | | |
| Nb of sheaves | 11 | 11 | 10 | | |
| Weight of sheaves (kg) | 30 | 30 | 33 | | |
| Time | 1mn51 | 1mn58 | 1mn56 | | |
| Grain (kg) | 12,8 | 11,7 | 12,0 | | |
| Straw (kg) | 14,2 | 13,4 | 12,7 | | |
| Drum speed (RPM) | 625 | 625/650 | 625 | | |
| Capacity (kg/h) | 415 | 357 | 372 | | |

↑ Peak capacity

No damaged grain
No grain in straw

Machine tested : MULTICROP THRESHER
Made : CATHOLIC RELIEF SERVICE
Date : June 1983, the 5th
Hour : from 10 AM to 1 PM
Place : FARANDIA EXPERIMENTAL FARM
Moisture content of grain : 11,6 and 11,7
Fans : 1/2 Open
Variety : G 157

| Test | 1 | 2 | 3 |
|---|---|---|---|
| Weight of sheaves | 27 kg | 32,5 kg | 31 kg |
| Time | 1 mn 28 s | 1 mn 57 s | 1 mn 52 s |
| Grain | 7 kg | 8 kg | 11 kg |
| Straw | 12,5 kg | 16,5 kg | 16,5 kg |
| Drum speed (peak) | 740 RPM | 720 RPM | 700 RPM |
| Damaged grain | No | No | No |
| Grain capacity/h | 286 kg | 246 kg | 353 kg |

Labour : 3 well trained and keen operators

No grain in straw.

## ALVAN BLANCH THRESHER

| FARAONIA ALVAN BLANCH THRESHER TESTS | 15 June 1983 | | | |
|---|---|---|---|---|
| | Test 1 Fans 3/4 | Test 2 1/2 | Test 3 open max. | Test 4 open max. |
| Weight of sheaves | 28,5 kg | 30 kg | 30 kg | 32 kg |
| Time | 1 mn | 1 mn 17 | 1 mn 15 | 1 mn 5 |
| Grain | 5 kg | 9 kg | 9,5 kg | 8 kg |
| Straw | 10,5 kg | 15 kg | 17 kg | 15 kg |
| Drum speed | 580 | 585 | 580 | 570 |
| Capacity | 300 kg/h | 420 kg/h | 456 kg/h | 443 kg/h |
| Moisture content | 11,6 | 11,3 | 11,3 | 12,5 |

$\bar{M}$ = 6 h/fed

No damaged gain
No grain in straw

A cascade sieve system could help improve this problem and I suggested it to M. BAHGAT.

The same team operated the first thresher to check if accurate feeding could improve its capacity but the results still proved the important increase in output of the new model i.e. twice the grain/hour.

I visited the big CRS thresher on a farm between SOHAG and ASSUT but it was not working and I was not able to ckeck the claimed capacity of 750 kg/hour of this bigger machine based on the same design.

B - ALVAN BLANCH Thresher

Remarks about the design

1 - There is no clutch between the engine and the main drive, hence in case of emergency it is not possible to stop the thresher and we think this is an unacceptable feature

2 - The straw chopper is mounted at the rear of the walkers and straw is not chopped as well as the material coming out of the conventional Egyptian threshers

3 - This design is also unable to thresh crops which are not fully dry. During the first attempt to test this machine we were not able to thresh and chop the crop which had been harvested that same morning. The grain was perfectly dry and ripe but the straw was still green at the base of the plant and we blocked the thresher immediately.

## TIME FROM CUTTING TO TRANSPORT WHEAT OUT OF THE FIELD

| OPERATION | CUTTING | BINDING | LAYING | TOTAL IN DAYS |
|---|---|---|---|---|
| COMBINE | | | | 0,56 * |
| AGOSTINI | ← 0,3 → | | 4,5 | 4,8 |
| SELF PROP. MOWER | 0,18 | 1,25 ** | 4,5 | 5,93 |
| TRACTOR + MOWER | 0,10 | 1,25 ** | 4,5 | 5,85 |
| TRADIT | ← 2,35 → | | 4,5 | 6,85 |
| *PROTOTYPE* | ← *0,3* → | | *4,5* | *4,8* |

* The straw is left in the field
** Hand work requiring 5 workers

## WHEAT HARVESTING : TIME/FEDDAN

| OPERATION | CUTTING | BINDING | LOADING + TRANSPORT | THRESHING | WINNOWING | GRAIN TRANSPORT | TOTAL |
|---|---|---|---|---|---|---|---|
| COMBINE * | ← | 2 persons | 2,5 h | → | | 2 (1) | 4,5 h * |
| AGOSTINI | ← 2 pers. | 4,8 h → | 2 pers.14,8h (2) | ← 3 pers. | 18 h → (3) | | 31,6 h |
| SELF PROP MOWER | 1 pers 1,4 h | 5 pers. 50 h | 2 pers.14,8h (2) | ← 3 pers. | 18 h → (3) | | 84,2 h |
| TRACTOR + MOWER | 1 pers 0,8 h | 5 pers. 50 h | 2 pers.14,8h (2) | ← 3 pers. | 18 h → (3) | | 83,6 h |
| TRADITIONNAL | ← 5 pers. | 94 h → | 2 pers.14,8h (2) | 3 pers. 15,9h (4) | 3 pers. 26,7h (5) | | 151,4 h |
| *PROTOTYPE MOWER BALLER + Feeding system on the thresher* | ← *2,5 h* (1) | → | *2 pers. 8,5 h (2)* | ← *2 pers.* (6) | *10 h* → | | *21 h* |

* The straw is left in the field. So plus 1 h/Fed for baler and 1 h/Fed for collecting and transport.
(1) Provided the tractor can enter the plot.
(2) Camel transport
(3) With the Alvan Blanch thresher
(4) With Behera thresher
(5) Hand-operated winnower
(6) With appropriate thresher

Yield : 5800 kg/h.

## V - HARVESTING SYSTEMS

The table "Wheat Harvesting : Tine/Feddan" shows the combine system needs the shortest time (but plots prove inaccessible with the combine); the Agostini system takes time for loading and transport, and the mowers for binding, loading and transport. In fact the Agostini system is a good system, but the design of the machine is not suited to Egyptian agricultural and industrial conditions. Besides gaining time in binding. If it were possible to gain time in loading and threshing as well as binding, this system would be better. It is difficult, at the moment, to achieve time savings on transport because of the problems of field accessibility. Time saving at loading can be obtained by handling bigger sheaves. A sheave can weigh about 60-70 kg (with the prototype of mower-baler) to be loaded on a camel or on a truck by two men in a shorter time than in traditional conditions or with the Agostini system (the weight of the sheave is about 3 kg). Time saving at threshing can be obtained by the use of a special feeder system on the thresher, if so with this new system, we can save, on the whole, about a third of the time and achieve labour savings at harvesting.

## CONCLUSION

If we consider the objective defined by Doctor EL SAHRIGI.

We should aim to reduce the cost of operation and speed up the harvesting to leave a clean field as soon as possible and this should be adapted to the prevailing agricultural practices :

The size of the fields are for { 80 % < 1,5 feddan
                               { 90 % < 2 feddans

This leads me to think that the use of combines is not yet an appropriate solution.

Furthermore the present types of machines are not designed to collect the straw and the straw is not chopped in an acceptable way. The length of cut and the splitting of each stem is not obtained with the present type of straw chopper.

In addition, the need to cut as low as possible with the present soil preparation and irrigation, does not encourage the use of a cutter bar far from the supporting wheel of the vehicle, even with features such as floating cutter bars or tables.

From an economic point of view, dropping the straw onto the ground, to be picked up and chopped with the present type of flail or hammer mill, is not the solution.

We believe that the evolution of the harvesting process will lead to the harvest of grain with a combine harvester, but land levelling and irrigation must develop to provide large fields and longer sections of land without cross ditches. One of the farmers concerned with this problem in FARANCIA was ready to accept this development but many other land owners do not see this as a solution within a short time.

The straw harvest is a problem and the length of cut remains an important factor in machine selection.

The use of conventional means to chop the crop (forage harvester) could provide a solution but power consumption will be high and the present type of tractor available is inadequate.

Meanwhile we believe that harvesting should be directed towards the collection of the crop by an efficient cutting and collecting system.

To reach the main objective i.e. harvest as quickly as possible with the present tractor available, I suggest a means of collecting the crop which requires the minimum amount of power per ton and the minimum of damage to the crop, with the ability to feed threshing machines at the farm evenly. This triple objective could be achieved by the use of a small round baler mounted on the 65 HP tractor available in the country.

Its speed in first gear being rather high, this baler must have a good capacity and a 1 m or 1 m 20 width baler could easily harvest 150 kg of crop per minute (300 kg by existing round balers is a common figure).

The actual belt speed of round balers (2 m 20/s to 3 m/s) should be reduced to minimise the damage to the crop while loose grain would be wrapped into the bale in any case. When the bale is unrolled to feed into the threshing machine, the same harvesting conditions will be repeated to ensure even feeding of the cylinder to improve the threshing performance. This is certainly an important parameter in the whole process.

## * MACHINE DESCRIPTION

A small round baler mounted on a 3-point linkage frame, with the rollers lengthwise to simplify the drive : no gear box with the PTO shaft parallel to the rollers; two main plates will support the rollers and the opening frame.

The baler chamber will be fed by a canvas, hinged around one of the lower rollers and mounted behind a 1 m 20 to 1 m 40 cutter bar hinged around a pivot to ensure break-away safety (probably the whole machine will pivot).

This canvas conveyor and cutter bar could be floating with the help of a castor wheel to be able to cut as low as possible, and adjustable in cutting angle by the top link of the 3-point mounting.

The size of the bale should be limited to keep the bale weight below 60 kg or 70 kg.

The tying mechanism will be as simple as possible. When the bale has reached its maximum diameter a simple warning device will tell the operator to start the twine rolling around the bale. The twine can be recovered when threshing and used again for harvesting.

This will reduce drastically the cost of twine.

When tying is finished the twine is cut by a scissor type cutter when the twine pipe is returned to its starting position.

We may have to use hydraulics to lift the opening frame with its belts but this function has to be carefully studied and other means of lifting the frame can be considered.

## * MACHINE FEATURES

- 3 point mounted - light and easy to install on the tractor
- Cutter bar as near as possible to the tractor rear wheels track, to make the cutting height control as easy as possible
- No expensive components such as gear box or sophisticated tying mechanism

. Belt tension being limited (density less than 100 kg/cubic metre) the reliability of the belt is easy to achieve

. Rollers mounted on sealed bearings for low maintenance costs

. Pre-chamber type of rolling action to control the formation of the bale at the early stage.

# ADDITION

## THRESHER PROJECT

To complete the harvesting process it has to be followed by the threshing and cleaning operations.

In this particular case the straw must be chopped and the length of chopped straw has to be very short.

It seems obvious that a stationary threshing machine has to be used; this machine could be of axial flow type and feeding into a chopper with 2, 4 or 6 blades acting against a fixed cutter located at the end of the axial flow drum.

The present type of cradle used on the Belin 2200 should be adequate to achieve the first stage of separation and control of the length of straw passing through the concave and drums. The present straw fan or impeller will be replaced by an axial flow multi-blade chopper as described.

This first approach is limited to general lines bearing in mind that further development work is needed but the basic threshing unit is very similar to the B 2200 design and I do not suggest to do this work during the same year devoted to the first operation, i.e. harvesting and collecting the crop.

# ANNEXES

MSP

FARAONIA FARM

CEEMAT TEAM.

# Wheat harvesting season planning 1983

## I- Main points

### 1. Equipment available

- Deutz Fahr combine
- Mower binder lli Agostini BCS
- Japanese combine
- Self-propelled Italian harvester
- Mower Ferrari on two wheel drive tractor
- Thresher-winnower local machine (CRS Beheira)
- Thresher Alvan-blanch
- Thresher Cicoria
- Mower double knife Busatis (24HP Tractor)
- Mower 24 HP Tractor Mitsubishi

### 2. 7 Harvesting systems to be evaluated

1- Deutz Fahr combine + Baler

2- Mower binder lli Agostini + thresher winnower CRS Beheira

3- Japanese combine + baler

4- Self-propelled Italian harvester + thresher Alvan-Blanch

5- Mower double knife Busatis (24 HP Tractor) + thresher Cicoria

6- Mower 24 HP Tractor Mitsubishi + Thresher Alvan Blanch

7- Mower Ferrari on two wheel drive + thresher Alvan Blanch

3. Method of evaluation work

1- Marking of the plots and samples. Place marking boards + sticks + string)

2- Sampling: by the method proposed by Dr. Tawakol Yuones

3- Harvesting: data Before
During
After.

4. Acreage

- All the acreage was measured so as to be sure the minimum was available

( - Deutz fahr combine : 5 Fed in)
( ) Faraonia Area
( 5 Fed in)
(
(
( 20 Fed in Private section (Ahmed Abd El Al-Centris)
(
( 10 Fed in Sbin El-Kom
( 40 Fed
(
( 20 Feddans are needed
(
Outside ( - Lli agostini + thresher winnower CRS-Beheira
(
the Farm ( 4 Fed private sector Mr. Gaber Faraonia (Farm)
(
( 30 Fed private sector in the Farm Area
( 34 Fed
(
( 24 Feddans are needed
(
(
( - Japanese combine
(
( Plots No. 7 and 8
(
( - Self propelled Italian harvester + thresher Alvan-Blanch
(
( Plots 9 and 10 and 11
(
( - Mower double knife busatis + thresher cloria
(
( Plots No. 4 and 5 and C

On the Farm
- Mower 24 HP tractor Mitsubishi + Thresher Alvan-Blanch — Plots No. 2 and 3
- Mower Ferrari on two wheel drive + thresher Alvan-Blanch — Plot No. 1

5. Management during the harvesting season

The management of the wheat harvesting season was done by Mr Delfosse who had the authority to change any methods or procedures for the collect of data on sampling or machinery.

The 3 Teams were - Combine team lead by Mr. Pirot

- Mowing-binding team ) Dolacinski 3 First days ) Suffissais following days
- Mowing team lead by Mr. Kirsch who is in charge of all the administrative problems
- Staff
- Incentives
- Transportation
- Timing of work
- Requirements

II- Sampling

1. Number of samples

- MSP Faraonia trials = 4 Samples for each plot

  11 x 4 = 44 Samples

- Gaber field = 2 Samples/Feddan

  4 x 2 = 8 Samples

- Private sector outside the farm (Big Farm)
- Deutz Fahr = 20 Feddans x 1 = 20 Samples
- Lli agostini = 20 Feddans x 1 = 20 Samples

2. To be recorded before harvesting (half day)

1- Number of plants /m²

2- Number of fertile tillers /m²

3- Number of tillers /m²

4- Total number of grain on the ground /m²

5- Weight of 1000 grains

6- Plant height maximum

7- Number of grain/Ear

8- Yield of grain Kg/m²

9- Yield of straw Kg/m²

10- Grain-Straw ratio

11- Moisture content of grain

12- Moisture content of straw

The samples collected and measured by each of the 3 teams.

3. Operating

1- To find the plot and the places where sampled

2- To dig the frame and close the frame

3- To measure plant height (From the soil to the top of the ear for the tallest tiller of 20 plants)

4- To cut all the plants inside the meter square frame (4 to 5 cm)

5- To count the number of plants

6- To count the number of fertile tillers

7- To count all the tillers

8- To take 20 plants (Fertile) and to put them in a plastic bag

9- To note the number of the plot and the number of samples in the plot.

10- To go outside the field to the table of observations.

11- To cut the ears from the straw

12- To weigh the ears

13- To count the number of grains per ear (10 ears) and put the grain in a plastic bag.

14- To count the number of spicklets per ear

15- To thresh the grain by hand

16- To weigh the grain and calculate the yield of grain/$m^2$

17- Moisture content of grain )
) 1 Observation by day by team.
18- Moisture content of straw )

* 2 hours are needed for Yield-sampling

* 1 hours is needed for Moisture sampling

## 4. Staff requirements

Yield sampling - Pirot team = 4 MEN During 10 days

Dolacinski Team = 3 MEN During 10 days
Suffissais

Kirsh Team = 4 MEN During 4 days

## 5. Sampling equipment requirements (For 3 Teams)

2 Moisture content measuring ovens (Over drying)

3 Balances weighing from 0,01g to 5000 g + Weights in non metric.

3 Balances weighing from 100 to 200 Kg

3 Tables (1,50m x 0,80m) + 9 Chairs

3 Tarpulins 5 x 5 m

200 Plastic bags 30 x 20 cm

12 Knives

12 Scissors

16 Marketing boards to denote plot number (stick 2m and 40 cm x 200 cm)

6 Meter square farme for sampling areas

4 Tape measures 5m

Labels for bags and sacks

12 Marker pens

10 Fountain pens

290 Sampling targe (AS Model)

## III- Harvesting

### 1. Planning: see Table 1

### 2. Detailed plans of work

#### 1- Combining team Mr. Pirot

Tape recorded (After checking with Mr. Farouk Abdu)

- Date, Place, Hour etc .... of the work.
- Timetable at work
- Total time in the field time/feddan
- Time and distance of access
- Time of breakdowns and maintenance
- Note on ease of turning of combine, turning time
- Crop stand (Lodged, Direction of lay, angle of ear, upright or necked over
- Fuel consumption per hour per feddan, oil for combines and tractors
- Spare parts used or repaired
- Notes about straw transportation, baling and/or cutting
- Amount of weeds or green leaf in crop
- Actual working width and theorical cut
- Forward speed in the field
- Optimum capacity and clearance between drum and concave for this throughput
- Drum speed

Grain = Damage on 1000 grains
Impurities (Grain in straw and straw in grain)
% of impurities

Straw = Length of stalk
Crushed stalk

After harvesting

Stubble height

Stubble weight

Grain on ground (Shedding Loss)

Grain on cloth (machine loss)

Straw transport (Baling etc) (Time)

Costs/Feddan (Fuel, Oil, Labour)
Reliability of Machine
Farmers Reaction

Plan of field showing bunds and ditches and heights/depth

dimensions

At the end of the season a detailed description of the equipment used has to be done (Specifications and observations)

Requirements

| | |
|---|---|
| Stop watches | 2 |
| Fuel measure | 2 (1 litre) + 1 test tube 100 ml (plastic) |
| Fuel tank 200 l | 2 |
| Oil tank 5 l | 4 |
| Tape - Meter 30 m | 2 |
| 1 $m^2$ Frame | 3 |
| Plastic bags | 100 (30 cm x 20 cm) |
| Sacks sisal + labels | 25 |
| Tarpaulin 1 x 5m W x 25 ml | |
| String | 100m |
| Masks | 5 |
| Glasses | 5 Pairs |
| Revolutuion counter | 1 |

3. Mowing binding team

To be recorded

- The same as combining team

Requirements

| | | |
|---|---|---|
| Stop watches | 1 | |
| Fuel measure | 2 | (1 litre + 1 test tube 100 mml) |
| Fuel tank 200 L | 2 | |
| Oil tank 5 L | 2 | |
| Tape - Measure 30 m | 3 | |
| 1 Meter square frame | 3 | |
| Plastic bags | 100 | (30 cm x 20 cm) |
| Sacks sisal + labels | 25 | |
| Tarpaulin | 2 | = 1 5m x 5m |
| | | 1 25m x 5m |
| String for Agostini | | |
| Masks (Dust) | 5 | |
| Glasses Pairs | 5 | |
| Revolution counter | 1 | |
| Tape measure 5m | 1 | |
| Table for threshing area | 1 | (1,50 x 0,80 m) |

4. Mowing team (Mr. Kirsh)

To be recorded

The same as combining team

Requirements

The same as for Beheira Prototype

Table 3

| Equipment | Requirements List |
|---|---|
| Tractor 65 HP | 3 |
| Tractor 24 HP | 2 |
| Baler | 1 |
| Trailer | 1 |
| **Transportation** | |
| Microbus | 2 |
| Pick-up | 2 |
| Car | 1 |
| **Staff** | |
| Samplers (Engineers) | 11 |
| Extension workers | 5 |
| Tractor drivers | 2 |
| Combine driver | 1 |
| **Miscellaneaous** | |
| Stop watch | 4 |
| Fuel measure 1 litre | 3 |
| 100 MML | 3 |
| Fuel tank 200l | 6 |
| Oil tank 5l | 6 |
| Tape measure 30 m | 6 |
| 5 m | 5 |
| Meter square frame | 15 |
| Balances 0,01 K to 5 Kg | 3 |
| 100 g to 200 Kg | 3 |

| | |
|---|---|
| Table | 5 |
| Chairs | 9 |
| Tarpulins 5 x 5m | 5 |
| 25 x 5m | 3 |
| Sacks sisal + Labels | 75 |
| String for Agostini | |
| Plastic bags 30 x 20 cm | 500 |
| Knives | 12 |
| Scissors | 12 |
| Marking boards | 16 |
| Marker pens | 12 |
| Fountain pens | 12 |
| Sampling target samples | 200 |
| Machinery | 100 |
| Masks for dust | 15 |
| Glasses pair | 15 |
| Moisture tester | 2 |
| Revolution counter | 3 |
| String for sacks | 300 m |

**********

TABLE I

| Management and Staff | Day | Place | Acreage Feddan | Equipment | Vehicle | Tractor (Machine) +Driver | Tractor + Driver for transpor | Trail | Baller +Tractor +Driver | Thresher for straw cutting +tractor + Driver |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | Faronia area | 2 | | | | Provided by the land lord | Provi- ded by the land lord | 1 | |
| Pirot | 2 | Faronia area | 3 | | 1 Microbus (Staff + Samplers) | | | | 1 | |
| | 3 | Centris | 5 | Deutz Fahr | | | | | 1 | |
| + Said Azab ( x Man) | 4 | Centris | 5 | | 1 Pick up | | | | 1 | |
| + Said Amer ( x Man) | | | | | | | | | 1 | |
| + Amin (Mecanic) | 5 | Centris | 5 | | 1 CAR (Pirot) | | 1 | 1 | 1 | |
| + 4 Samplers | 6 | MSP Plots 7 et 8 Faronia. | 1,70 | Japonese comb | | | 1 | 1 | - | |
| + 1 Combine driver | 7 | MSP Plots 9 and 11 Faronia | 2,40 | Self propeled Italian harvester | | | | | | |
| | 8 | | | + Alvan blanch | | | | | | |
| Dolacinski) Suffissais) 3 First days | 1 | Faronia MSP Plot 1 and 4 | 2 | | 1 Microbus | 2(65HP) | 1 | 1 | | |
| Suffissais following days | 2 | Faronia Mr. Gaber | 2 | | 1 Pickup (Serge) | 2 | 1 | 1 | | |
| + Farak (Assistant) | 3 | | 3 | lli | | 2 | | | | |
| + Abd El-Salam ( Mecanic) | 4 | | 3 | | | 2 | | | | |
| + Adel Abuc Magd (Exn) | 5 | Faronia | 3 | Agostini | | 2 | | | | |
| + Abdi El Natah (Exn) | 6 | Area | 3 | + Beheira | | 2 | | | | |
| + 3 Samplers | 7 | | 3 | Threshers | | 2 | | | | |
| + 2 Tractor drivers | 8 | | 3 | | | | | | | |
| Kirsch | 3 | MSP Plots 10 Faronia | 0,85 | Mower ferar, 2 ruled Driver + Alvan Blanch | 1 Pick up | | 1 | 1 little | | |
| + Amin (Mechanic) | 4 | MSP plots 2 and 3 Faronia | 1,68 | Mower mitsubushi 24HP + Alvan Blanch | | 1(24HP) | 1(24HP) | 1 little | | |
| - Mohamed Yossef - 4 Samplers | 5 | MSP Faronia Plots 5,6 | | Mower Double knife Busatis + Cicoria | | 1(24HP) | 1(24HP) | 1 little | | |

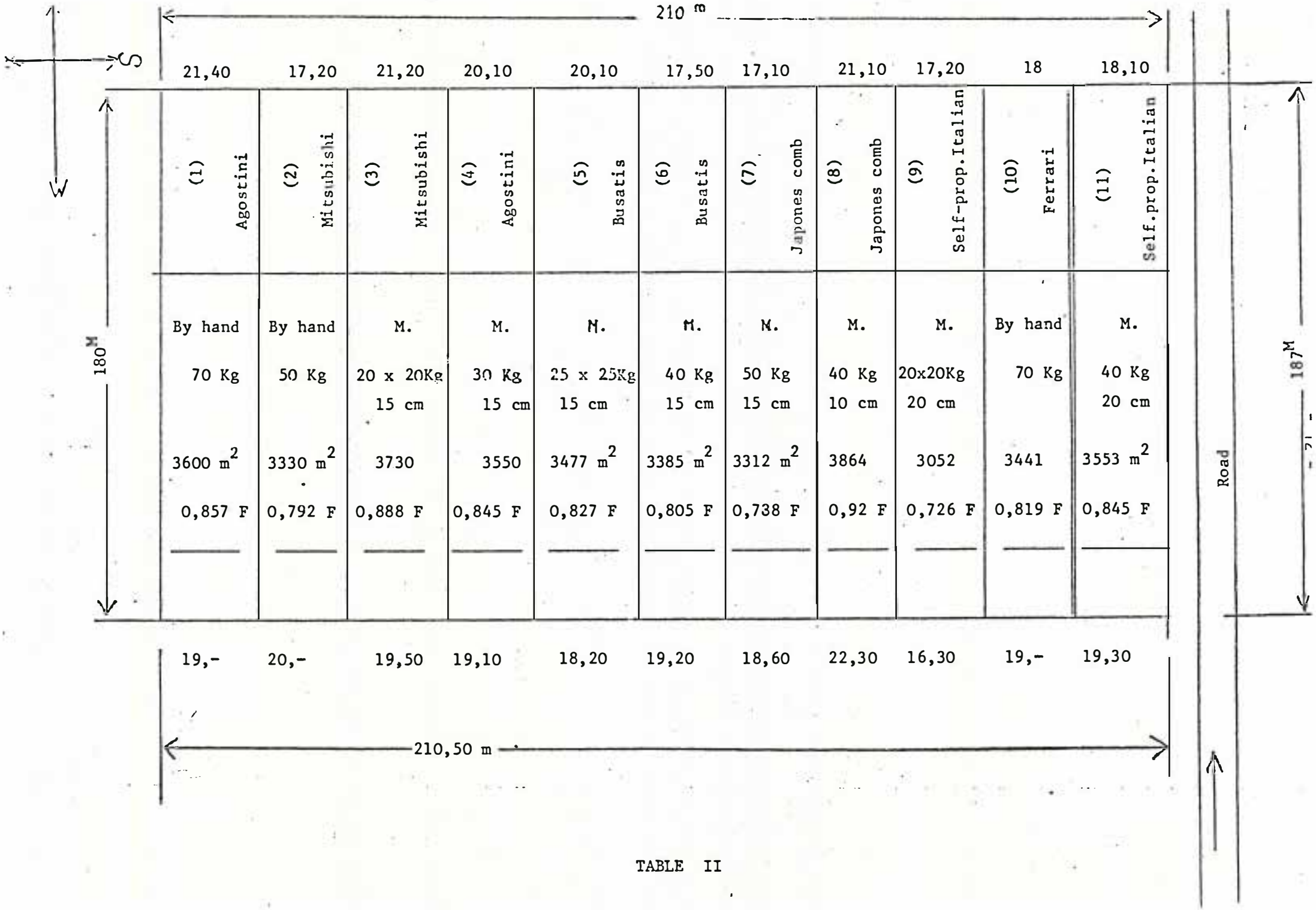

210 m
S
W
21,40
17,20
21,20
20,10
20,10
17,50
17,10
21,10
17,20
18
18,10
(1) Agostini
(2) Mitsubishi
(3) Mitsubishi
(4) Agostini
(5) Busatis
(6) Busatis
(7) Japones comb
(8) Japones comb
(9) Self-prop.Italian
(10) Ferrari
(11) Self.prop.Italian
By hand
By hand
M.
M.
M.
M.
M.
M.
M.
By hand
M.
70 Kg
50 Kg
20 x 20Kg
15 cm
30 Kg
15 cm
25 x 25Kg
15 cm
40 Kg
15 cm
50 Kg
15 cm
40 Kg
10 cm
20x20Kg
20 cm
70 Kg
40 Kg
20 cm
3600 m2
3330 m2
3730
3550
3477 m2
3385 m2
3312 m2
3864
3052
3441
3553 m2
0,857 F
0,792 F
0,888 F
0,845 F
0,827 F
0,805 F
0,738 F
0,92 F
0,726 F
0,819 F
0,845 F
180M
187M
Road
19,-
20,-
19,50
19,10
18,20
19,20
18,60
22,30
16,30
19,-
19,30
210,50 m

TABLE II

# GENERAL TESTING CONDITIONS

## 1) Weather Conditions

. Cloudless and sunny

. Temperatures between 86 and 92° F

## 2) Management and staff

| | |
|---|---|
| Supervisor | DELFOSSE Gilbert, Consultant on wheat harvesting |
| Management | DOLACINSKI Bernard, Team Leader, CEEMAT |
| | FARAK Mohamed, Assistant Farm Manager |
| Advisor | Dr. TAWAKOL YOUNES (AIN CHAMS) |
| | Dr. AGDU FAROUK (MSP) |

Teams

Combining team
- PIROT Roland, CEEMAT Engineer
- AMIN EL AGAMI, Mechanic
- MOHAMED, Engineer Rice Mechanization Project Kafr el Cheir, as driver
- TAWFIK MOHAMED YOUSSEF, Faraounia, as driver

. Mowing-binding team
- SUFFISSAIS Serge, CEEMAT Technician
- DOLACINSKI Bernard, Team Leader, CEEMAT
  + 2 extension engineers

. Sampling
. 4 teams
- SAID AMER (MSP extensionist)
  + 3 extension workers from Government

- MOHAMED YOUSSEF (MSP extensionist)
  + 3 extension workers from Government
- HEMDI NAHTA (MSP extensionist)
  + 3 extension workers from Government

  SAID FAME (MSP extensionist)
  + 3 extension workers from Government

. Measurements
- ADEL ABOU EL MAGD (MSP extensionist)
  + 2 extension workers from Government
- SAMI EL SAYAY, Agronomist

3) Requirements

MOHAMED DIRSCH (Farm Manager) made every effort to supply the equipment required for the testing programme.

Nevertheless there were some problems :

i/ an experimental thresher and winnower were expected but never reached the farm

. a thresher was quickly constructed by the Kanater workshop but could not be used due to problems with the electric current in Faraonia

. the samples were mainly hand-threshed which took up much of their time

. grain winnowing also was done by hand taking up much time.

ii/ moisture content

An electronic moisture meter was supplied (not included in the contract) by CEEMAT but its lower limit of measurement limited its use.

Instantaneous measurement of the straw moisture content could not be obtained; nevertheless such a parameter is of the upmost importance for these tests.

On June 6th samples were sent to AIN CHAMS through Mr. FAROUK ABDU but there are no results to date (July 25th).

iii/ Deficiencies in the accuracy of the balances

iv/ Lack of working tables (desks were used as substitutes); considering the importance and timeliness needed of wheat harvesting MSP should be provided, for the next campaign, with the following basic experimental equipment

- . 1 laboratory thresher
- . 1 laboratory winnower
- . 2 analytical balances
- 1 automatic moisture tester for grains
- . 1 moisture tester for straw
- . 5 tables with trestles.

After agreement with MSP quotations can be supplied by CEEMAT-NIAE.

4) Staff

Although the Farm Manager's absence (Mr. MOHMED KIRSCH was ill) was felt, the staff's participation, especially the 5 extension workers, has been exemplary, and consitutes a promise for the future of MSP in Menufia.

CEEMAT is making the necessary arrangements for obtaining an agro-economist (recent graduate) for the next wheat harvest so as to define more accurately the economic aspect of the wheat harvest, both on the experimental farm and among the traditional Egyptian Fellahs.

It is regretted that the 5 extension engineers, responsible as the sampling teams, could not perform the in-field tests with the machines.

5) Equipment

i/ Combines — a straw baler and a straw chopper are required for the next wheat harvest to allow the complete testing of the combining system

- the combines must be tested next year under effective conditions (i.e. 0.5 to 1.5 feddan-plots and not 6.5 feddans as it is the case at Centris).

ii/ Mower-binder :

During the last wheat harvest the use of mower-binders, and especially the Agostini, was made difficult because of a previous agreement between the Farm staff and the Fellahs (general big farms) that the harvest on the Fellah farms must be made with the equipment of the Experimental Farm.

In the future such commitments, if to be carried out, should be made a long time in advance and included in the planning procedures before the harvest and submitted to the MSP Executive Committee.

iii/ Tractors

Results concerning fuel and lubricant consumption with Universal tractors must be considered but with caution because

a) tractors are worn and inadequately serviced

b) these are short-term tests.

6) Time of work

- Due to organisational and transport factors it was never possible to effectively begin in-field work before 10 a.m. so tests were carried out under conditions different to those of Fellahs since they work from 6 to 10 a.m. and then from 5 p.m. to night.

- For the next harvest a new time-table is being discussed with the staff concerned. Work may be performed between 2 p.m. and 2 a.m. As the MSP testing plots are located near the farm (after cotton) we can use the farm's generator set for lighting.

The time table would be as follows :

2 p.m. to 4 p.m. = transportation and installation of the equipment

4 p.m. to 8.30 p.m. = sampling and testing

9 p.m. to 1 a.m. = working on test results.

7) Next season management

The number of systems to be evaluated must be reduced and limited to big combines, small combines, mower binder, mower, prototype.

Each of the 5 extension engineers will be responsible for a defined number of testing plots and corresponding tests.

- 2 plots

  sampling and data processing (operators'management)

- tests and estimates of machines in operation

- writing out of the test report.

## EFFICIENCY TEST

| | |
|---|---|
| MACHINE TESTED | : MOWER BINDER |
| MADE | : AGOSTINI MLP 140<br>HEAD BCS |
| DATE | : MAY 23rd |
| HOUR | : 11 a.m. |
| PLACE | : FARAONIA EXPERIMENTAL FARM |
| PLOT | : N° 1 |
| LABOUR | : 1 man to pull the thieves from the conveyor |
| PLOT DIMENSION | : Length : 1,74 m<br>Width : $\frac{11,40 + 10,10}{2}$ = 10,75 m |
| CROP STAND | : Normal |
| VARIETY | : G 157 |
| AGREAGE | : 1.870 m² |
| NUMBER OF SHEAVES | : 930 |
| TOTAL WEIGHT OF PRODUCT | : 4.265 kg |
| WORK TIME | : 70 minutes |
| PAUSING TIME | : 6 minutes 30 seconds (String setting) |
| MAINTENANCE TIME | : 0 in the test |
| TIME OF ACCESS | : 8 minutes |
| DISTANCE OF ACCESS | : 750 meters |
| THEORITICAL WIDTH | : 1,30 meter |
| ACTUAL WORKING WIDTH | : $\frac{10,75}{9}$ = 1,194 m - env. 1,20 m |
| FORWARD SPEED ON 10 METERS | : 15 seconds - 16 seconds - 15 seconds |
| THEORITICAL FORWARD SPEED | : 2,4 km/h |
| BREAK DOWNS AFTER THE TEST | : A crack in the aluminium carter front size of the machine. The straw and dusts have come through the carter and the chain has been demaged and remover.<br>Total time de repairing : 4 hours. |

## EFFICIENCY TEST

### TEST 1

| | |
|---|---|
| MACHINE TESTED | : MOWER BINDER |
| MADE | : AGOSTINI HEAD BCS MLP 140 |
| DATE | : MAY 1983, the 23rd |
| HOUR | : 9 a.m. |
| PLACE | : FARAONIA EXPERIMENTAL FARM |
| PLOT | : N°1 |
| VARIETY | : G 157 |
| LABOUR | : 1 man to pull the sheaves from the conveyor |
| LENGTH OF THE FIELD | : 174 m |
| LENGTH OF THE TEST | : 174 m |
| NUMBER OF SHEAVES | : 87 |
| WEIGHT OF THE HARVESTED PRODUCE | : 399 kg |
| TIME ON WORK | : 6 minutes and 34 seconds |
| IDLE TIME | : 41 seconds |

### TEST 2

| | |
|---|---|
| MACHINE TESTED | : MOWER BINDER |
| MADE | : AGOSTINI MLP 140 HEAD BCS |
| DATE | : MAY 1983, the 26th |
| HOUR | : From 4 p.m. to 5 h 25 p.m. |
| PLACE | : FARAONIA EXPERIMENTAL FARM |
| PLOT | : N° 8 |
| PULLED BY MASSEY FERGUSON 265 | : 2400 RPM 540 PTO 1st range low |
| FIELD | : Length : 175 m<br>Width : $\frac{13,9 + 15,4 + 15,4}{3}$ = 14,9 m |
| NUMBER OF SHEAVES | : 1230 - 7 runs up and 7 runs down |
| ACTUAL WIDTH OF CUTTING | : 14,9 = 1,06 m |
| THEORETICAL WIDTH OF CUTTING | : 14 = 1,30 m |
| DISTANCE OF ACCESS | : 1 km 25 |
| TIME OF ACCESS | : 9 minutes |
| IDLE TIME | : 14 minutes 45 seconds = 7 minutes for string removals (engine switch)<br>5 minutes05 for a divider breakdown<br>2 minutes40 for idle travel in the field |

## EFFICIENCY TEST

### TEST 3

FIELD : 175 m x 14,9 m
FIELD ACREAGE : 2.607 m²
TIME OF ENGINE GOING : 1 hour 18
FUEL CONSUMPTION : 3,7 litres
RATE OF FUEL CONSUMPTION : 2,84 litres/hour or 5,96 litres/Feddan

MACHINE TESTED : MOWER BINDER
MADE : AGOSTINI HEAD BCS MLP 140
DATE : MAY 1983, the 22 nd
HOUR : 10 a.m.
PLACE : FARAONIA VILLAGE
VARIETY : G 157
TENANT : ABDELAZIZ GOUMA EL NOMMOCSI

| NUMBER OF TEST | | 1 | 2 | 3 |
|---|---|---|---|---|
| Number of sheaves on the 10 meters Tarpaulin | | 3 | 3 | 3 |
| Weight of the sheaves | | 11,3 kg | 11,8 kg | 12,2 kg |
| Weight of 1 sheaf | | 3,7 kg | 3,9 kg | 4 kg |
| Head losses weight | Total weight | - | - | 249 g |
| | Clean grain | - | - | 95 g |
| Rear end losses weight | Total weight | 537 g | 785 g | 667 g |
| | Clean grain | 68 g | 169 g | 133 g |

Time to travel 10 meters : 18 seconds.

## LOSSES TEST

MACHINE TESTED : MOWER BINDER
MADE : AGOSTINI HEAD BCS MLP 140
DATE : MAY 23th, 1983
HOUR : 1 p.m.
PLACE : FARAONIA EXPERIMENTAL FARM
PLOT : 1
VARIETY : G 157

| N° OF TEST | | 1 | 2 | 3 |
|---|---|---|---|---|
| Number of sheaves on the 10 meters Tarpaulin | | 3 | 3 | 3 |
| Weight of the sheaves | | 13 kg | 13 kg | 13,5 kg |
| Weight of 1 sheaf | | 4,3 kg | 4,3 kg | |
| Head losses weight | Total weight | 153 g | 70 g | 80 g |
| | Clean grain | 64 g | 36 g | 34 g |
| Rear end losses weight | Total weight | 1440 g | 575 g | 1552 g |
| | Clean grain | 244 g | 140 g | 551 g |

## LOSSES TEST

MACHINE TESTED : MOWER BINDER
MADE : AGOSTINI HEAD BCS MLP 140
DATE : MAY 24th, 1983
HOUR : 11 a.m.
PLACE : FARAONIA EXPERIMENTAL FARM
PLOT : N° 4
VARIETY : G 157

| N° OF TEST | | 1 | 2 | |
|---|---|---|---|---|
| Number of sheaves on the 10 meters Tarpaulin | | 4 | 4 | |
| Weight of the sheaves | | 19,050 kg | 17 kg | |
| Weight of 1 sheaf | | 4,7 kg | 7,2 kg | |
| Head losses weight | Total weight | 37 g | 30 g | |
| | Clean grain | 23 g | 22 g | |
| Rear end losses weight | Total weight | 424 g | 288 g | |
| | Clean grain | 168 g | 115 g | |

MACHINE TESTED : SELF PROPELLED MOWER
MADE : SEP SUPER EXTRA LOMBARDINI ENGINE
DATE : MAY 1983, the 26th
HOUR : 9 a.m.
PLACE : FARAONIA EXPERIMENTAL FARM
VARIETY : G 157

PLOT : 2 TEST 1

LENGTH OF FIELD : 180 m
LENGTH OF TEST : 175 m
TIME TO RUN : 175 m UNLOAD : 2 minutes 30 seconds
RANGE : 1° SPEED

IN WORK : on 175 metres

Total time : 5 minutes 8 seconds
Pausing time : 33 seconds
Working time : 4 minutes 35 seconds

PLOT : 2 TEST 2

LENGTH OF FIELD : 180 m
LENGTH OF TEST : 175 m
RANGE : 1° SPEED

IN WORK : on 175 metres

Total time : 5 minutes 30 seconds
Pausing time : 20 seconds
Working time : 5 minutes 10 seconds

| PLOT : 3 | TEST 1 | TEST 2 |
|---|---|---|
| LENGTH OF FIELD | : 180 metres | 180 metres |
| LENGTH OF TEST | : 176 metres | 176 metres |
| RANGE | : 1° SPEED | |

IN WORK : 176 metres

PLOT : 2 TEST 3

THEORETICAL WIDTH OF CUTTING: 1,40 metres (Nominal with 1,45 metres)
WIDTH OF THE FIELD : 20 metres
8 runs up and 8 runs down = 16 runs
ACTUAL WIDTH OF CUTTING = 1,25 metres

PLOT : 2 TEST 4 FUEL CONSUMPTION

FUEL CONSUMPTION : 1° GEAR FULL POWER IN WORK

| | | |
|---|---|---|
| Area harvested | : | 100 x 20 m = 2000 m² |
| Quantit of fuel | : | 300 ml |
| Total time | : | 33 minutes 28 seconds |
| Hourly fuel consumption | : | $\frac{0{,}300 \times 3600}{2008}$ = 0,537 l/hour |

TEST 5 STUBBLE HEIGHT TEST

PLOT : 3 STUBBLE HEIGHT AVERAGE

| | | | | |
|---|---|---|---|---|
| 7 | 8 | 10 | 9 | 6 |
| 16 | 9 | 13 | 10 | 6 |
| 7 | 8 | 4 | 8 | 7 |
| 9 | 5 | 15 | 11 | 9 |
| 6 | 3 | 14 | 9 | 7 |
| 8 | 5 | 10 | 10 | 10 |
| 5 | 3 | 13 | 7 | 9 |
| 9 | 25 | 11 | 8 | 11 |
| 6 | 23 | 8 | 6 | 6 |
| 7 | 11 | 10 | 3 | 9 |
| 9 | 10 | 11 | 8 | 11 |
| 7 | 12 | 12 | 10 | |

AVERAGE : 9.11 cm

MACHINE TESTED : MOWER
MADE : MITSUBISHI Model MTM 1500
PULLED BY : KUBOTA L 245 DT
DATE : MAY 1983, the 26th
HOUR : 12
PLACE : FARAONIA EXPERIMENTAL FARM

PLOT : N° 3
VARIETY : G 157
FIELD DIMENSIONS : Length : 175 m
Width : $\frac{11.75 + 12.40 + 13.80}{3}$ = 12.65 m

THEORETICAL WIDTH OF CUTTING : 1,50 m (1,52 on catalog)

ACTUAL WIDTH OF CUTTING : 5 runs up and 4.3 runs down i.e. 10 runs

$$\frac{12,65}{10} = 1,26 \text{ m}$$

SPEED OF WORKING

| | | |
|---|---|---|
| Time for 175 meters | 5 minutes 02 | |
| " | 5 minutes | |
| " | 4 minutes 57 | 25 mn 09 total time |
| " | 4 minutes 07 | Average 5 minutes 02 seconds |
| " | 5 minutes 03 | |

FUEL CONSUMPTION

Time of test : 25 mn 09
Quantity of fuel : 820 ml
Fuel consumption : $\frac{0.820 \times 3600}{1509}$ = 1.95 l/h

WEIGHT LOSSES AFTER MANUAL BINDING (BAD WORK)

| SAMPLE | 1 | 2 | 3 |
|---|---|---|---|
| AGREAGE | 1 m² | 2 m² | 2 m² |
| TOTAL WEIGHT | 38 g | 155 g | 584 g |
| STRAW | 5 g | 84 g | 412 g |
| CLEAN GRAIN | 15 g | 45 g | 73 g |

# MITSUBISHI MOWER

## LABOUR TEST

FOR BINDING MANUALLY 2214 m²

FOR EACH WAY + 36 mn 45
29 mn 20
31 mn
+ 24 mn
15 mn (just before lunch)

* Non significant the 12 operators were not keen to bind the sheaves; the time has decreased with each run.

Total time : 2 hours 16 mn 35

Time for 1 feddan : 4 h 20 mn

## STUBBLE HEIGHT

4 3 5 6 7 5 3
4 6 6 6 5 8 7
3 7 8 10 6 3 4
5 3 4 4 3 3 4
3 6 7

Average 5 cm

MACHINE TESTED : MOWER
MADE : BUSATIS BM 1102
PULLED BY : TRACTOR MTB 65
DATE : JUNE 1983, the 1st
HOUR : 9 a.m.
PLACE : FARAONIA EXPERIMENTAL FARM
PLOT : 6
PULLED BY : MTB 65 RPM 2400 PTO : 540 1st low range
SPEED OF WORKING
ON 37,70 m : 28 seconds $\frac{0.0377 \times 3600}{28}$ = 4.84 km/h
25 seconds
VARIETY : G 157

## TEST 1 EFFICIENCY TEST

THEORETICAL WIDTH OF CUTTING : 1,50
ACTUAL WIDTH OF CUTTING : Width 10 metres
8 runs up and down

Actual width $\frac{10}{8}$ = 1,25 metres

## TEST 2 LOSSES TEST

| SAMPLE/1m² | 1 | 2 |
|---|---|---|
| TOTAL WEIGHT | 185 g | 170 g |
| STRAW | 130 g | 128 g |
| CLEAN GRAIN | 24 g | 20 g |

## TEST 3 HEIGHT OF CUTTING TEST

REMARK : Many stems were cut twice and we found many pieces of straw from 3 to 8 cm long.

STUBBLE HEIGHT

| | | | | | | |
|---|---|---|---|---|---|---|
| 4 | 6 | 3 | 9 | 3 | 9 | |
| 3 | 4 | 4 | 4 | 4 | 12 | |
| 4 | 4 | 5 | 3 | 3 | 3 | |
| 5 | 4 | 3 | 5 | 4 | 4 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | 10 | 12 | 6 | 4 | 3 | |
| 4 | 6 | 5 | 3 | 8 | 7 | |
| 3 | 5 | 4 | 4 | 5 | 3 | |
| 3 | 6 | 4 | 4 | 3 | 3 | |
| 3 | 10 | 4 | | | | |

AVERAGE : 4,8 cm

## TRANSPORTATION

| | |
|---|---|
| DATE | MAY 1983, the 24th |
| PLACE | FARAONIA VILLAGE |
| METHOD | CAMEL |
| SHEAVES MADE BY HAND | |
| WEIGHT OF THE LOAD | 400 kg |
| NUMBER OF SHEAVES | 20 |
| NUMBER OF SHEAVES MADE/FEDDAN | 22 |
| LABOUR TO HELP LOAD THE CAMEL | 3 |
| TIME TO LOAD THE CAMEL | 10 minutes 15 seconds<br>13 minutes |
| COST FOR TRANSPORTATION | 17 £E |

## QUESTIONNAIRE ON TRADITIONAL HARVESTING

TIME OF TOTAL WORK

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Time to harvest 1 Feddan (in hours) | 12 | 12 | 15 | 8 | 8 | 7 | 12 | 10 | 17 | 14 | 13 | 8 | 12 | 13 | 12 | 8 | 12 | 24 | 11 | 10 | 9 |
| Total time to harvest - 1 Feddan (in hours | 144 | 72 | 150 | 80 | 48 | 70 | 132 | 80 | 119 | 140 | 104 | 64 | 96 | 104 | 96 | 72 | 84 | 72 | 77 | 80 | 81 |
| Time between mowing and transport (by days) | 3 | 5 | 5 | 7 | 7 | 2 | 4 | 3 | 1 | 4 | 3 | 5 | 5 | 5 | 4 | 3 | 1 | 3 | 3 | 4 | 7 |
| Time of transport for 1 feddan (in hours) | 7 | 8 | 6 | 6 | 6 | | 8 | 10 | | 6 | | 8 | 8 | | | | | 8 | 8 | 8 | 2 |
| Time of threshing for 1 Feddan (in hours) | 6 | 5 | 6 | 6 | 5 | 4 | 5 | 5 | 4 | 5 | 6 | 6 | 5 | 5 | 5 | 5 | 6 | 6 | 5 | 6 | 5 |
| Time of winnowing for 1 Feddan (in hours) | 8 | 9 | 8 | 10 | 6 | | 8 | 10 | 8 | 9 | 8 | 8 | 12 | 12 | 11 | 9 | 10 | 6 | 8 | 8 | 10 |
| Total time for 1 Feddan | 168 | 99 | 175 | 109 | 72 | | 157 | 108 | | 164 | | 91 | 126 | | | | | 95 | 101 | 106 | 105 |
| % | 85,7 | 72,7 | 85,7 | 73,3 | 66,6 | | 84 | 74 | | 85,3 | | 70,3 | 76 | | | | | 75,8 | 76,2 | 75,4 | 77 |

COST OF TOTAL WORK

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cost of the harvesting | 48 | 47 | 50 | 48 | 48 | 48 | 55 | 36 | 60 | 50 | 48 | 38 | 50 | 48 | 50 | 49 | 50 | 54 | 52 | 60 | 48 |
| Total cost of the harvesting (work & food) | 58 | 57 | 67 | 58 | 55 | 67 | 51 | 48 | 26 | 66 | 63 | 50 | 67 | 65 | 65 | 61 | 60 | 69 | 65 | 71 | 61 |
| Cost of the transport by camel | 12 | 17 | 16 | 12 | 10 | 8 | 14 | 15 | 18 | 13 | 15 | 12 | 25 | 23 | 22 | 21 | 27 | 30 | 30 | 21 | 22 |
| Cost of the treshing | 28 | 27 | 29 | 28 | 27 | 22 | 20 | 26 | 20 | 28 | 25 | 23 | 35 | 35 | 33 | 32 | 35 | 36 | 32 | 30 | 33 |
| Cost of the winnowing | 17 | 15 | 27 | 15 | 15 | 15 | 26 | 29 | 30 | 29 | 25 | 24 | 25 | 25 | 26 | 23 | 25 | 23 | 22 | 25 | 23 |
| Total cost | 115 | 116 | 139 | 113 | 107 | 112 | 41 | 118 | 130 | 136 | 128 | 114 | 152 | 148 | 145 | 137 | 142 | 158 | 149 | 147 | 139 |
| Cost of harvesting % of total cost | 50 | 49 | 48 | 51 | 51 | 60 | 46 | 41 | 48 | 49 | 49 | 44 | 44 | 44 | 45 | 45 | 41 | 44 | 44 | 48 | 44 |

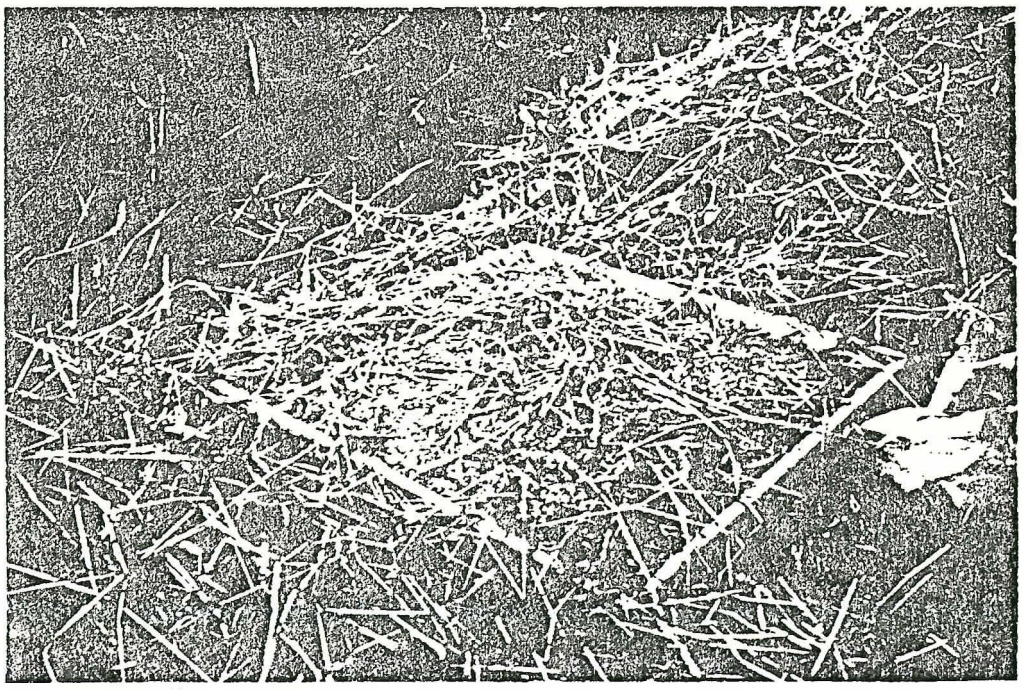
FARONIA FARM

Wheat trials

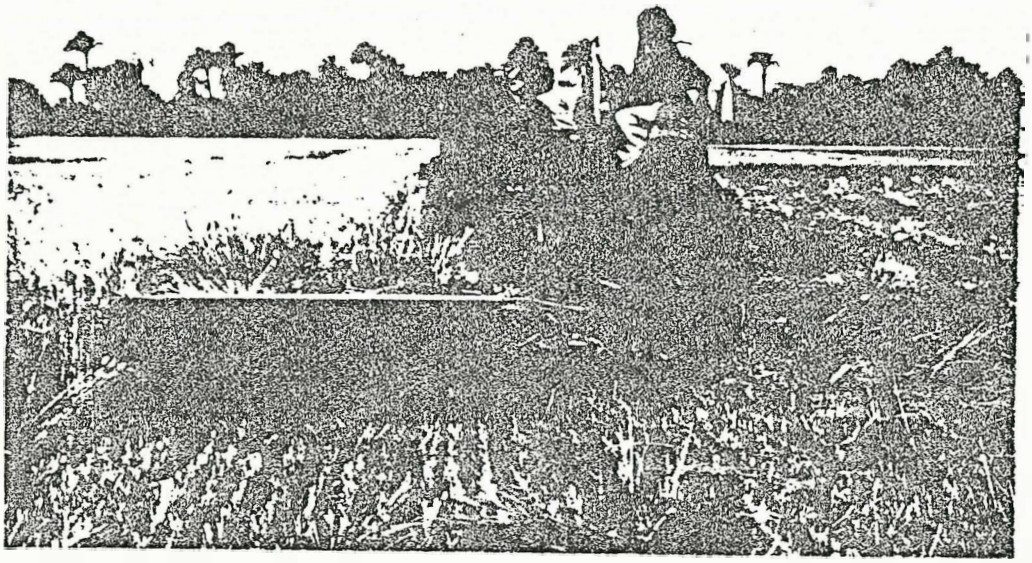
| Plot - rsr | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Fellahs: Kafr Abou Mahmoud | Gaber Field | Abed El Aziz El Homesy | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Yield grain/Fed. (4000) m² | 4360 | 2252 | 3845 | 3524 | 3352 | 3617 | 3080 | 2700 | 3572 | 3440 | 3144 | 2004 | 3273 | 2068 | |
| Yield straw/Fed (4000) m² | 7140 | 3752 | 5085 | 8280 | 4328 | 4896 | 7792 | 5116 | 5572 | 6080 | 4660 | 5464 | 6118 | 4000 | |
| Ratio grain/straw | 0,610 | 0,600 | 0,756 | 0,413 | 0,774 | 0,738 | 0,395 | 0,528 | 0,641 | 0,565 | 0,683 | 0,366 | 0,537 | 0,517 | |
| Yield grain/ha (19500) m² | 10355 | 5348.5 | 8773.4 | 8369.5 | 7965.7 | 8588 | 7315 | 6412.5 | 8483.5 | 8170 | 7562 | 4759.5 | 7766.25 | 4911 | M 5812 |
| Yield straw/ha (19500) m² | 16957.5 | 8911 | 12074 | 1966.5 | 10279 | 11628 | 18506 | 12131 | 13233.5 | 14440 | 11067.5 | 12977 | 14530.25 | 9500 | |

Experimental thresher built by MSP

Samples in the fields

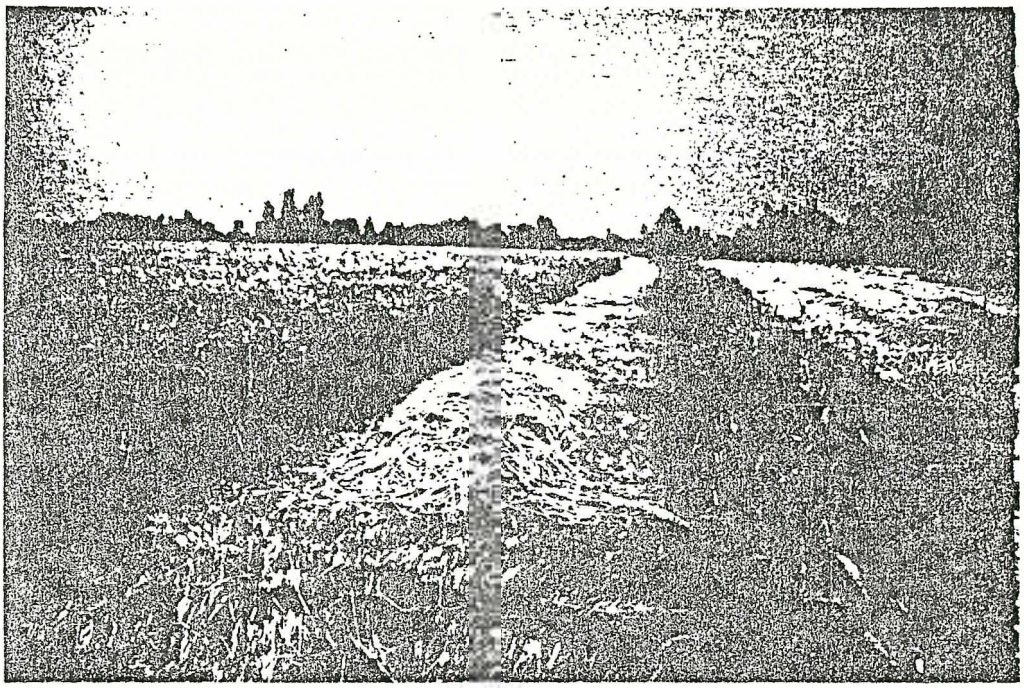


Frame for the losses samples in combine harvesting

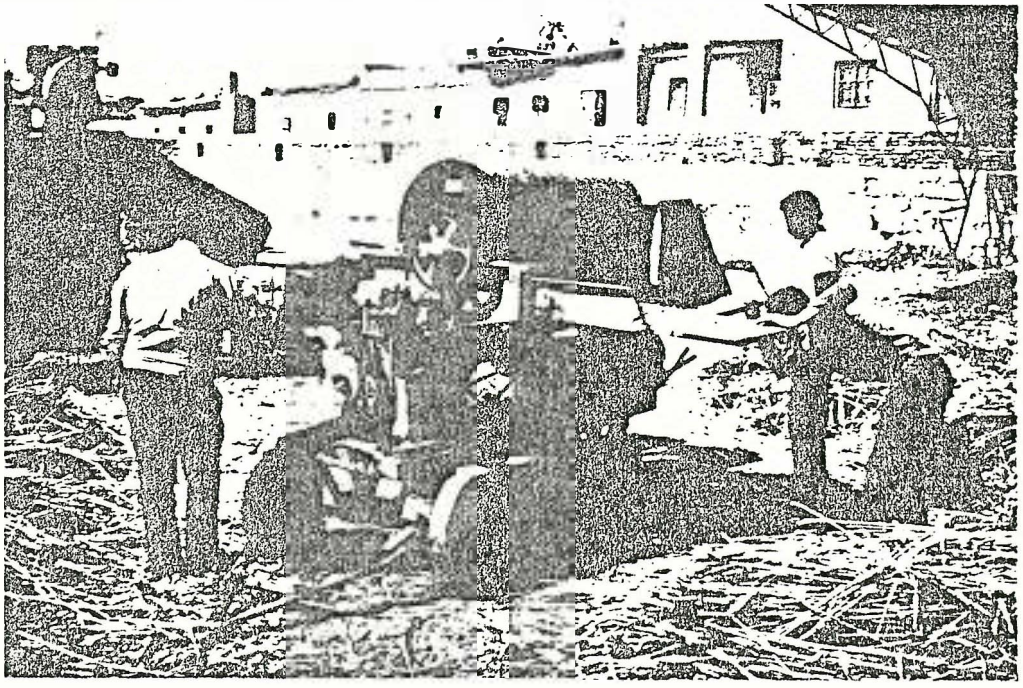


Agostini mower binder

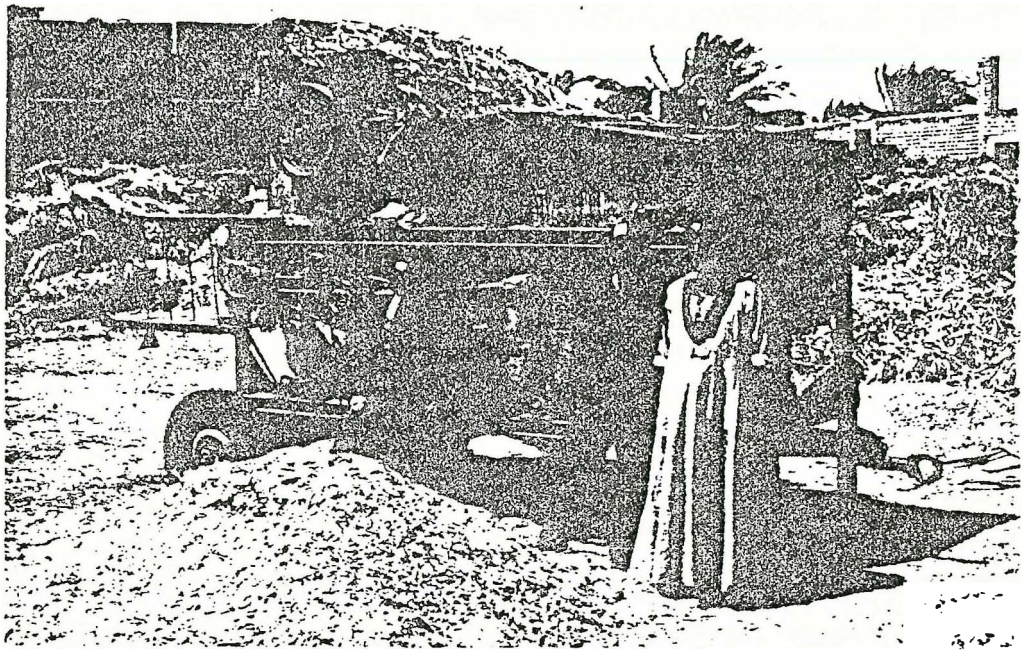
Harvest after Ferrari mower



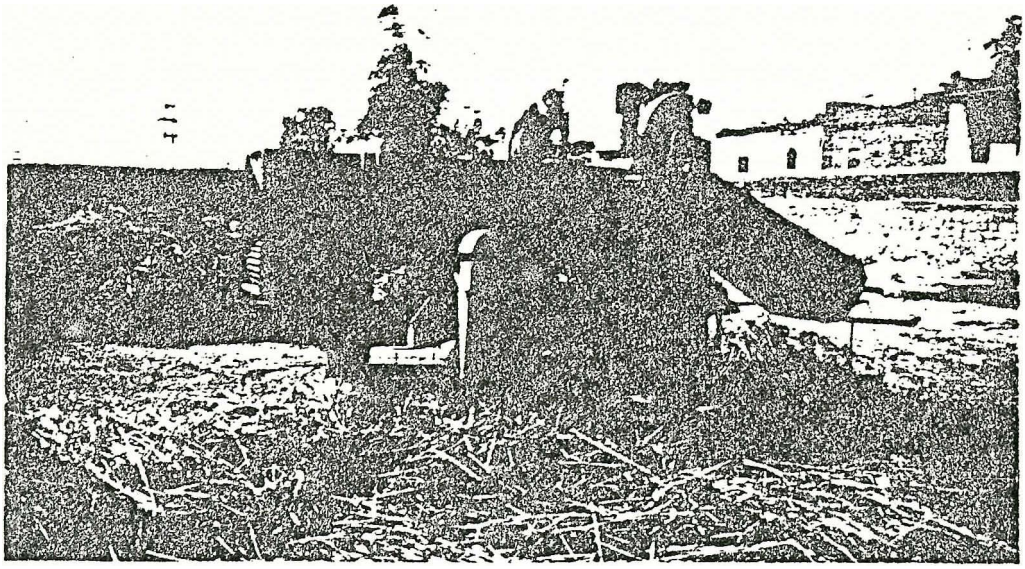
Harvest after Mitsubitchi mower



CRS Thresher (model A)



CRS Thresher (model B)



Alvan Blanch Thresher